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Response of combined body of medusa and polyp zooid that transplanted on medusa of *Turritopsis* sp. (Hydrozoa, Anthomedusae)

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Introduction

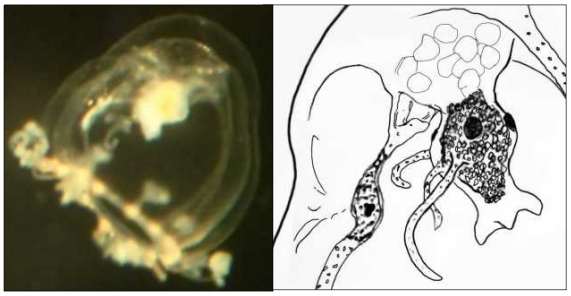
Turitopsis medusa from Japan can be easily rejuvenated from sexual generation to asexual generation caused by aging or stress, and spreads as a well-developed polyp colony with growing stolons over substrata (Kubota, 2005, 2011, 2013; Kubota and Niina, 2014). We conducted the first experiment that we transplanted a polyp zooid on a medusa as a preliminary experiment for a study of colony specificity, using the identical genotype.

Materials & Methods

We used a colony that was rejuvenated only once from one immature medusa of *Turritopsis* which was collected in Tanabe Bay, Wakayama Prefecture in September, 2010 (Kubota, 2013) and many immature medusae (clones) that had separated from this colony. In the summer of 2014, we pierced a small hole from upper part of each umbrella of seven medusae through to an inner surface of the umbrella with a stainless steel needle and we transplanted one polyp zooid cut from the colony into each hole of these seven medusae, and we then observed the reactions.

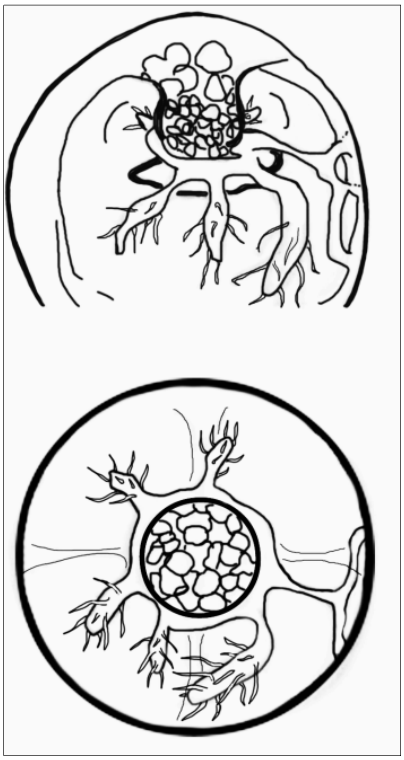
We used a total of seven pairs of polyps and medusae for this experiment. On one of the pairs, we pierced through a straight hole from top of the umbrella to the lowest part of the vacuolated mass and transplanted one polyp zooid in this hole. We pierced the holes diagonally on the rest of the umbrellas (Fig. 1). We kept the combined bodies in the natural sea water filtered by 5 μm sieve and a set temperature of 25°C. At the beginning of the experiment, we did not feed the usual food *Artemia* nauplii to any of the pairs. We started feeding after we once confirmed they were alive. Both the medusae and polyps of the same genotype were able to prey without any trouble.

Figure 1. A clone polyp zooid transplanted diagonally on a medusa's upper part of umbrella to the inner part of *Turritopsis* sp. originated in Tanabe Bay, Wakayama Prefecture, Japan.



Figures 2, 3. Some tentacle-like organs were formed from *Turritopsis* sp. manubrium after transplantation of zooid as Fig. 1 (Left, Fig. 2: photo; Right, Fig. 3: sketch).

Figure 4. One stolon grew from the transplanted polyp zooid to the inside of the manubrium of medusa of *Turritopsis* sp. after transplantation as Fig. 1.



Figures 5, 6. Stolons grew from the transplanted polyp zooid and wound around the outer manubrium of the medusa of *Turritopsis* sp. and formed five new polyp zooids after transplantation of zooid as Fig. 1 (Upper, Fig. 5: side view; Lower, Fig. 6: aboral view).

Results & Discussion

In two pairs, polyp zooids were almost assimilated, however they formed some tentacle-like organs (Figs 2, 3) and stuck them out from their manubriums. It is inferred later that they formed new tentacles.

In the other two pairs, the stolons grew along the surface of subumbrella and some new polyp zooids were formed. One stolon grew from the mouth to the stomach in one of these two (Fig. 4). On the other one, the stolon wound around the outer surface of the manubrium and formed an annular shape, then five new polyp zooids were formed from there after 5 days of transplantation (Figs. 5, 6). Then, the stolons constricted the manubrium and it became difficult to engulf the prey.

In one case of the combined body that we transplanted the polyp zooid into the hole from the top of the umbrella straight through the upper part of the manubrium, the medusa became extremely weak when we pierced the hole and it died.

For the remaining two cases out of seven pairs, both the medusae and polyps died and vanished one day after the transplantation, and the rejuvenation did not taken place.

The above-mentioned two specimens that grew the tentacle-like organs (Figs. 2, 3) were relatively long lived and they remained as they were for some weeks, however after that, the combined bodies of medusa and polyp zooid became the nodules and they were rejuvenated and became the polyps. The one that the stolon grew into the stomach (Fig. 4) died. And the other one that the stolon wound around the outer manubrium (Figs. 5, 6) was assimilated into the polyp colony.

From the result of this experiment, there are possibilities that the forcibly combined two bodies of clone (with the same gene) survive together for a while as they are, even though they are from the different generations such as medusa and polyp, although it is presumed that this phenomenon is very unlikely to happen in the nature. Consequetly the combined bodies were either rejuvenated or died.

Summary

We transplanted a polyp zooid cut from the colony into each umbrella hole of immature medusa of *Turritopsis* sp. (collected in Tanabe Bay, Wakayama Prefecture) cultured at the Seto Marine Biological Laboratory, Kyoto University. Forcibly combined two bodies of clone survive together for a while as they are, and they were either rejuvenated or died, after various spreading way of zooid in the subumbrellar cavity and the manubrium of medusa of the same genotype.

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